

## The flora of the Watchung Mountains

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### PART I—GEOLOGY OF THE REGION\*

Five phytogeographic provinces are represented in the Local Flora area. The area is therefore the most complicated, physiographically and phytogeographically, of any similar-sized area in all of North America. This fact must be borne in mind when one studies the flora of any part of the local area, such as that of the Watchung Mountains.

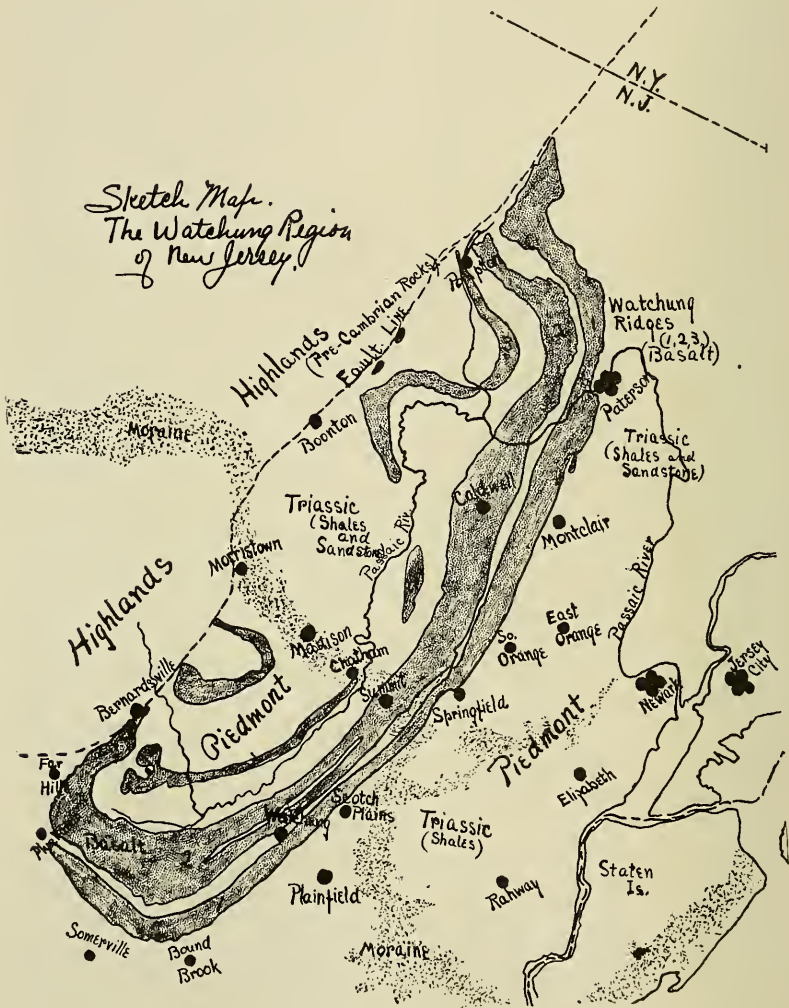
The Watchung Ridges (as they are termed by geologists) or Watchung Mountains (as they are known locally) are three in number.<sup>1</sup> Of these the longest is the First Watchung, which is also the farthest east. It is approximately 50 miles in length, through eastern Passaic Co. and western Essex and Union Cos., forming a bow-like curve from western Bergen Co. on the north, terminating in northern Somerset Co. It passes through Paterson and just west of Orange and Plainfield, and at Bound Brook turns sharply westward to Pluckamin. The Second Watchung parallels the First, only a mile or so westward, and separated by a belt of red sandy shales forming the shallow Washington Valley. It runs through Little Falls, Caldwell, and Summit, and in northern Somerset Co. swings sharply to the west and then north, terminating at Bernardsville. The so-called Third Watchung is really a series of 4 disconnected ridges closely parallel to the First and Second, but lower and separated by a narrow red sandstone belt. Still farther westward, wholly in Morris Co., is a fourth ridge, very small and crescent-shaped.

The Watchung Mountains are in general about 500 or 600 feet high—the highest point being High Mt. (876 ft. above sea-level) just north of Paterson in the Second Watchung. All four series of ridges lie within the so-called Piedmont physiographic and phytogeographic province and are made up of volcanic rock (basalt), with, in a very few isolated spots, narrow intervening bands of red sandy shale of the same sort as makes up the valleys between them. They are of Triassic age. They

\* Part 2 of this paper, on the plants of the region, will be printed in the next number of *Torreyia*.

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are bounded on the east by the Coastal Plain province, which is composed of more recent geologic formations (from the Cretaceous to the present). The Piedmont province is of older rock



structure, considerably planed down, and underlying the Coastal Plain sediments. The northernmost portion of the Piedmont section is known geologically as the Piedmont Lowlands and is of Triassic age, composed of red sandstones and red

shales, with igneous intrusions like the Palisades and the trap ridges at Princeton and Hopewell and along the Delaware River, and the Watchung ridges. The Piedmont plains are usually 100 or 200 feet above sea-level, somewhat higher in the



First Watchung Mountain: quarry West Orange—  
showing columnar structure.

north. Westward and northward of the Watchung Mountains lies the so-called New England province, composed of geologically very old rocks (schists, gneisses, and much granite intrusive), all Pre-Cambrian and underlying the other two provinces. Two prongs extend southwestward from New Eng-

land, separated by the Piedmont region. The eastern of these (Manhattan Prong) forms Manhattan Island; the western (Reading Prong) runs in a narrow belt across New Jersey (Sussex, Passaic, Morris, Warren, and Hunterdon Cos.) to Reading, Pa. The New Jersey Highlands and Ramapo Mountains lie in this prong. It is separated from the Triassic Piedmont to the east by a gigantic fault scarp. This fault was doubtless begun during the Appalachian Mountain revolution and formed the western edge of a large arid or semi-arid valley which, through erosion from the mountains to the east and west, filled with sand during the Triassic. The flows of lava which now form the Watchung Mountains doubtless came up along this fault and spread eastward over the valley of sands. There were a number of lava flows, all in late Triassic time. Both the First and Second Watchungs are made up of several separate lava flows, those of the First being the oldest. In some cases (like Eagle Rock and Garret Rock) the lava seems to have come up through vents. Several large volcanoes were located along the fault line during this time. The climate was generally cool. Fossils of a few small fresh-water fish and some fragments of land plants have been found. The fern fragments seem to indicate that they were washed in by floods from the surrounding mountains. Cycads were common and there were a few lingering pteridosperms. Some of the so-called algae described from the region are not plants at all, but are merely ripple-marks. They are commonly found in the old shallow lake-beds along with abundant mud-cracks, attesting to the arid or semi-arid climate. It was the early reptilian age, marked by the rise of dinosaurs. Footprints of small dinosaurs are commonly found through the region, mostly of the 3-toed, bird-like, carnivorous species, which fed upon one another. The mountains surrounding this vast sandy valley may have been *sparsely* covered with vegetation. The preceding geologic period had been very cold and characterized by many vast glaciers which certainly exterminated all the early plants of the region. The vegetation, however, gradually came back during the Triassic and Jurassic, so that in Cretaceous time there was an abundant flora over the area, including grasses and primitive dicotyledons. In the Triassic, conditions here were similar to those in valleys in the West today. Heavy rains during the winter washed much sand



and gravel, often with plant fragments, into the valleys from the mountains. There were some small lakes, and a few intermittent streams existed, but there was apparently no large river in the entire area that is now New Jersey, and the Watchung region had no outlet to the sea.

After the Triassic lava flows had quite ceased, the intrusive diabase masses forming the Palisades and similar southern ridges were pushed up between the hardening sandstones. During the Jurassic the whole area was lifted up, probably into low mountains, then subjected to erosion and planed down during the Cretaceous (since late Cretaceous deposits overlay the Tertiary in southern New Jersey). During the Jurassic climatic conditions were changed until they became more as they are today. No fossils are known from the Highlands rocks, but in the Cretaceous beds they are numerous.

In Tertiary time the Atlantic transgressed over the entire state of New Jersey (and New York up to the Catskill area at least). Fossils from beds of this period represent a wholly marine fauna, with shells and corals much like the modern ones. In the Pleistocene came an uplift of the region and active planing down of the land through erosion of the softer sandstones and shales, leaving the harder igneous ridges (such as the Watchungs) exposed. This was followed by the southward advance of the glaciers, with their accompanying glacial climate—the ice extending as far south as Staten Island. The terminal moraine runs just east of Plainfield, through the First Watchung at Scotch Plains and through the Second Watchung at Summit, then through the northern extremity of the southernmost ridge of the Third Watchung to Madison and Morristown, just north of the fourth ridge. The retreat of the glaciers left, just north of the fourth ridge and west of the Third Watchung, the old glacial Lake Passaic, of which the lake-bed can still be plainly discerned. We see, thus, that approximately the northern two-thirds of the First, Second, and Third Watchungs were glaciated in the Pleistocene and the southernmost one-third not glaciated. The fourth ridge was entirely unglaciated.